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(54) Materials incorporating active carbon

(57) A textile product (10) comprises first and second layers (16A, 16B) of textile material defining therebetween a plurality of pockets (12A, 12B) and granules (14) of active carbon contained in the pockets.

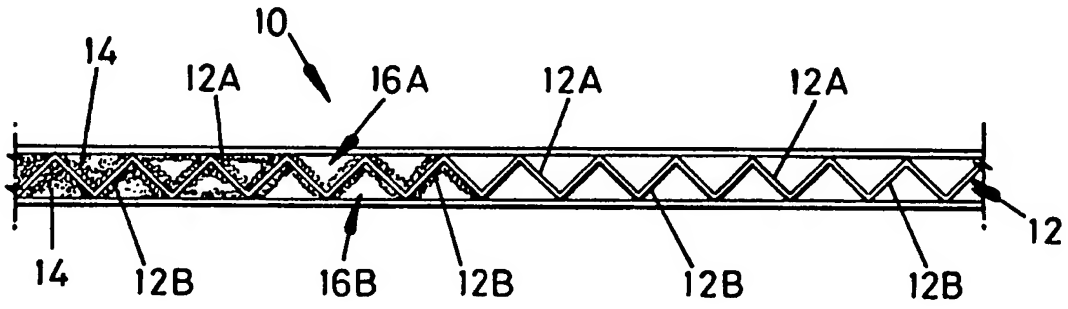

FIG.1

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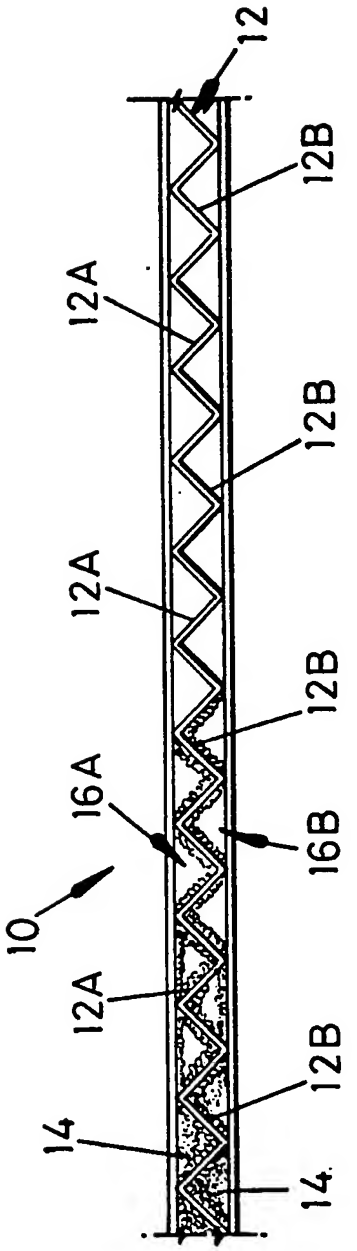

FIG.1

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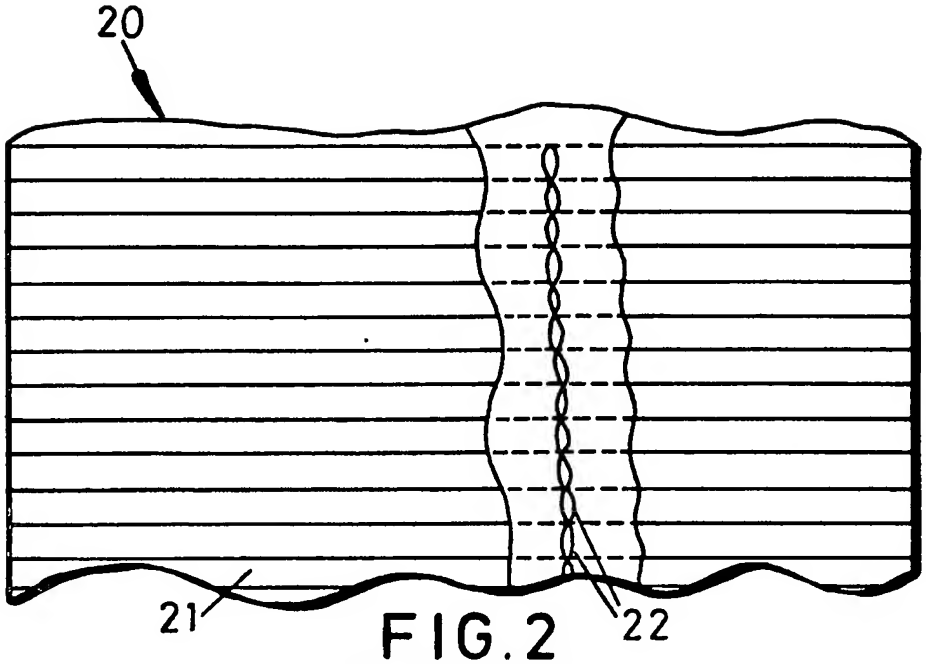

FIG. 2

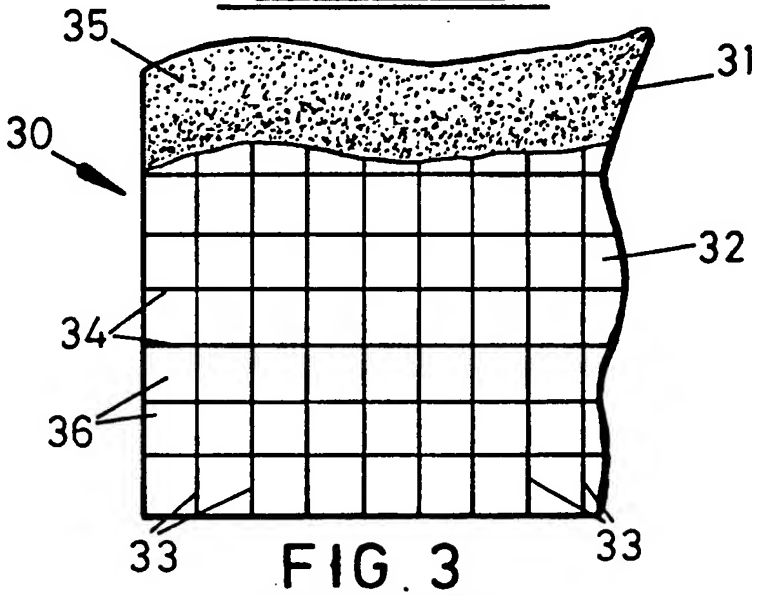

FIG. 3

SPECIFICATION

Materials incorporating active carbon

This invention relates to materials which incorporate active carbon.

Such materials have been proposed in the past—for example, for use in clothing to afford protection against toxic liquids and gases. Although the effectiveness of active carbon for absorbing toxic substances is well known, materials which have been proposed to date tend to be very fragile. Generally, they are in the form of a charcoal-containing cloth, and charcoal, being naturally somewhat brittle, tends to provide very little in the way of resistance to wear and abrasion. In particular, it is very difficult to sterilise such cloths after contamination, ready for re-use.

Preferred embodiments of the present invention aim to provide materials which incorporate active carbon, and which may be improved in the following respects.

According to a first aspect of the present invention, there is provided a textile product comprising first and second layers of textile material defining therebetween a plurality of pockets, and granules of active carbon contained in the pockets.

Where the contexts admits, the expression "textile material" includes in this specification also non-woven materials, or carbon film (synthetic composition).

In one arrangement, the pockets may be defined by an intermediate layer of textile material which is disposed between the first and second layers. Such an intermediate layer may be preformed to a corrugated configuration—for example, by means of a heat treatment.

In another arrangement, said first and second layers may be woven simultaneously such that the pockets are formed integrally during weaving, and extend parallel to the weft of the material.

Where the pockets extend parallel to the weft of the material, they may each have a width in the range of 10 to 30 mm.

In another arrangement, the pockets may be formed by quilting the first and second layers. The quilting may comprise rectangles of which each side has a length in the range 10 to 30 mm.

The material of at least one of said layers may be of polyvinyl chloride and/or, if a textile material, of aromatic polyamide fibres/textile fabric.

A respective layer of carbon film containing polymer material may be disposed adjacent to the first and/or the second and/or the intermediate layer of textile material. The, or each such, layer of carbon-containing polymer material may not be gas permeable, and/or will be substantially impervious to moisture, being of the sandwich resembling arrangement for the purpose of the sonar detection.

According to a second aspect of the present invention, there is provided a method of manufacturing a textile product in accordance with the first aspect of the invention, comprising the steps of:

mixing granules of active carbon with a liquid carrier to form an emulsion;

applying the emulsion to one face of each said first and second layers;

securing together said first and second layers with faces facing inwardly, and forming said pockets; and

removing the carrier from said first and second layers, to leave said granules within said pockets.

Such a method may include the step of allowing the liquid carrier to dry, at least partially, prior to securing together said first and second layers.

Said first and second layers may be secured together by stitching, and are combined with the quilting method.

The carrier may be an alginate—for example, a polymer alginate.

The carrier may be removed from the first and second layers by scouring, for which water may be used.

According to a third aspect of the present invention, there is provided a method of manufacturing a textile product, comprising the steps of:

providing two layers of carbon-containing polmer material;

adhering granules of active carbon to one face of at least one of said layers; and

securing said layers together with said one face therebetween.

The granules may be adher d to said fac during manufacture f th respective layer. For example, the granules may be adhered to said fac , being emulsified with the alginate polymer to mobilise th active carbon uniformly.

For a better understanding of the inv ntion and to show how the same may be carried into effect, r ferenc will now be mad , by way of example, to the accompanying diagrammatic drawings, in which:

Figure 1 is a sectional view of a first textile product; the product designated against the sonar detection or absorbance of the infra-red spectrum.

Figure 2 is a plan view, with a part broken sectional view, of a second textile product; and
Figure 3 is a plan view, with a part broken sectional view, of a third textile product.

In Fig. 1, the textile product 10 comprises first and second layers 16a, 16b of textile material, between which there is disposed an intermediate layer 12, also possibly of textile material. Preferably, all of the layers, 16a, 16b, and 12, are gas permeable.

The intermediate layer 12 has been pre-formed, e.g. by a heat treatment, to a corrugated shape, such that it defines, together with the first and second layers, 16a, 16b, a plurality of elongate pockets, 12a, 12b. Typically, the textile product 10 is produced in a length, with the pockets 12a, 12b extending transversely thereof. Each pocket 12a, 12b is substantially filled with granules of active carbon 14.

It will be appreciated that the construction of the textile product 10 affords particular advantages in use. The layers 16a, 16b and 12, may readily be made permeable to any hazardous substance against which protection is desired. At least the outer layers, 16a, 16b may be made of a material which is non-abrasive and has good wear characteristics—for example, synthetic carbon film or aromatic polyamide textiles. As the active carbons are free to act, since they are independent from the pre-formed construction, the textile product 10 as a whole may be quite resistant to wear.

In one arrangement, the outer layer 12 film may be of a material which itself contains carbon. For example, I have been working on synthetic carbon-containing materials where particulate carbon film, for example, as carbon granules, is dispersed throughout a suitable polymer host. I have tried both aliphatic and aromatic polymer hosts, and am interested particularly in those of the water solvent type. Such materials may generally be formed from a precursor material in which carbon and polymer are intimately mixed, for example by milling together in appropriate proportions. Then, such a precursor material can be processed, either by extrusion of thermoplastic resin, or by casting from a relatively liquid state to a flexible solid state, using a suitable solvent that is readily driven off, even such as toluene, dimethyl-formamide toluene, or isopropanol, in proportion to the required viscosity, a typical composition having about 30% solids, with carbon amounting to 12% to 55% of the solid polymer by weight. Such materials may be readily produced as a solid film, by casting and driving off solvent while curing. The aim has been to produce resulting materials having certain desired electrical conductance/resistance properties accompanied by good wear characteristics and physical strength with resistance to abrasion, corrosion and moisture.

More specifically, a suitable carbon-containing polymer material for the layer 12 may be made from a precursor material comprising an appropriate solid particulate aromatic polymer and granular carbon, for example, graphite available in fluffy pellet type as Vulcan XC72, or Corax L6, in a proportion of 25% to 55% by weight of the polymer. As mentioned above, the constituents are thoroughly admixed, as by milling, and dissolved in a suitable solvent that is readily driven off, and preferably incorporates a foaming agent.

The intermediate layer 12 may be composed of a layer of such carbon-containing polymer material, or alternatively, may comprise a suitable carrier material (e.g. a textile material) to which such a carbon-containing polymer material is fixed. The carbon-containing polymer material may present a surface which is particularly receptive to the active carbon granules 14, and therefore helps to retain the granules in contact therewith.

The granular active carbon 14 may be incorporated or associated with such a carbon-containing polymer material of the intermediate layer 12, at a stage of production where a film, coating or layer of the carbon-containing polymer material is wet or otherwise presents a surface receptive to the granular active 14. Thus, the active carbon granules 14 may be adhered to the oppositely facing surface of the corrugated layer 12, prior to the application of the outer layers 16a, 16b.

The permeability and nature of the first and second outer layers 16a, 16b may be different if desired, as may be dictated by the use to which the textile product 10 is to be put.

The granular active carbon 14 may have a particle size in the range 75 to 125 microns. The carbon granules may be provided as an amorphous form of carbon, obtained, by example, from the destructive distillation of nut shells or other organic carbonaceous material. For example, the production process may comprise heating to a temperature in the range 800°C to 900°C in steam, to open up a highly extensive int rnal porous or honeycomb structure.

It will be appreciated that the provision of the granular active carbon material 14 may provide properties which compliment thos afforded by a carbon-containing polymer material, of a type d scribed above. F r xampl , such a carbon-c ntaining polymer material in at least one of the layers 16a, 16b and 12 may pr vide a layer of carbon which is of a n n-metallic, non-p lar and allotropic natur , giving highly desirabl characteristics, such as high electrical conductivity, invisibility to radar and infra-red detective systems, etc. In particular, such a layer may be particularly ffectiv in absorbing, and therefor appearing invisible to underwat r sonar detection systems. The inclusion of the active carbon granules 14 may further enhance such properties, and als give high absorptiv capability for toxic gases and micro-organisms.

In a particularly useful variant for underwater use (eg. for absorbing sonar detection signals), the intermediate layer 12 is of a textile material comprising polyvinyl chloride, which has been set to a corrugated form, by a preliminary heat treatment. The first and second outer layers 16a, 16b, are each of a carbon-containing polymer material—for example, of the type described above—and each is impervious to both gas and to moisture.

Uses of a textile product such as 10 include not only protective clothing, covers, packaging etc., but also use for purification, deodorising, fume removal etc., which may be required in the treatment of water and/or air, air conditioning, clean rooms, airports, and the chemical industry (including electroplating).

It is envisaged that substantial advantages may be obtained from a textile product such as 10, by avoiding the use of cellulosic textile materials, as disclosed in British Patent No 1 301 101 and U.S. Patent No 3 969 268. In particular, there may be much reduced abrasiveness, and a reduction of any tendency to discharge microscopic particles of carbon, which may have serious long term effects on the respiratory systems of users. Moreover, partial obstruction of active carbon particles by bonding agents such as latex rubber may be avoided, or at least substantially reduced.

The textile product 20 that is shown in Fig. 2 comprises first and second layers 21 of textile material which are formed simultaneously during weaving, to define a plurality of parallel elongate pockets 22, which extend parallel to the weft of the textile material. For example, each pocket 22 may have a width in the range 10 to 30 mm.

It will be appreciated that the textile product 20 may readily be produced in a single weaving operation, and thereafter, the pockets 22 filled with active carbon in the form of granules (for example, of a type as discussed above with reference to Fig. 1). Preferably, the textile material is of aromatic polyamide fibres, which may exhibit excellent flame retardancy and high tensile strength, together with resistance against inorganic and organic chemicals.

If desired, once the pockets 22 have been filled with granular active carbon, layers of carbon-containing polymer material may be applied to the outer surfaces of the synthetic film carbon product 20, as may be done also in the embodiment of Fig. 1. Such outer layers of carbon-containing polymer material may make the finished product substantially impermeable to moisture.

The textile product 30 that is illustrated in Fig. 3 comprises first and second layers 31 and 32 of textile material—preferably, of aromatic polyamide fibre. The two layers 31 and 32 are quilted together by means of orthogonally extending rows of stitching 33, 34. The thread used for stitching is also preferably an aromatic polyamide fibre. The quilting produces rectangular pockets which, in this example, are square, having a side dimension in the range 10 to 30 mm (preferably, 18mm).

To manufacture the textile product 30, granules of active carbon are emulsified in a liquid alginate polymer, which is then applied to the first and second layers 31 and 32. The alginate is then allowed to dry or cure, at least partially, such that it is retained firmly on the layers 31, 32, with the active carbon granules dispersed more or less uniformly thereon.

Thereafter, the two layers 31, 32 are stitched together, to form the quilting as described above. Following this, the textile product 30 is then scoured with water, to dissolve and rinse away the alginate, and thereby leave the active carbon granules 35 distributed substantially uniformly on the inner surfaces of the layers 31, 32, within the rectangular pockets 36 which are defined by the seams 33, 34.

It will be appreciated that such a method may be used to manufacture the textile product 30 in a very simple and economic manner, the textile product 30 having various possibly uses and advantages. For example, the active carbon will serve to absorb all toxic liquid and gases, whilst the strength of the textile material allows the product 30 to be sterilised repeatedly for re-use, after contamination. The product 30 may also provide thermal protection (insulation) in cold weather, to which end it may be made up into a garment.

Further, the textile product 30 may serve to absorb both radar and infra-red detection signals.

By using aromatic polyamide fibre, the product 30 is substantially non-flammable.

Particularly importantly, as mentioned above, the described method of manufacturing the textile product 30 enable such products to be produced particularly economically, for a given quality.

By way of example, a suitable material for the first and second layers, 31 and 32, is as follows:

DECITEX	WARP/WEFT	580
CONSTRUCTION	WARP/WEFT	295 DTEXZ530 XS530
WEAVE	WARP/WEFT	12.8 ENDS/PICKS PER CM
WEIGHT	WARP/WEFT	160 GRAMMES/SQ METRE

This invention is not restricted to the details of the foregoing embodiment(s). The invention extends to any novel combination, of the features disclosed in this specification and/or draw-

ings, or to any novel one, or any novel combination, of the steps of any method or process disclosed herein.

CLAIMS

1. A textile product comprising first and second layers of textile material defining therebetween a plurality of pockets, and granules of active carbon contained in the pockets.

2. A textile product according to Claim 1, wherein said pockets are defined by an intermediate layer of material which is disposed between said first and second layers.

3. A textile product according to Claim 2, wherein said intermediate layer is pre-formed to a corrugated configuration, by the pleated method to be suitable for underwater use.

4. A textile product according to Claim 3, wherein said intermediate layer has been so preformed by a heat treatment.

5. A textile product according to Claim 1, wherein said first and second layers have been woven simultaneously such that pockets have been formed integrally during weaving, and extend parallel to the weft of said material.

6. A textile product according to any preceding claim, wherein said pockets extend parallel to the weft of said material, and each has a width in the range 10 to 30 mm.

7. A textile product according to Claim 1, wherein said pockets are formed by quilting the first and second layers.

8. A textile product according to Claim 7, wherein said quilting comprises rectangles of which each side has a length in the range 10 to 30 mm.

9. A textile product according to any preceding claim, wherein said material is of polyvinyl chloride.

10. A textile product according to any one of the Claims to 8, wherein said material is of aromatic polyamide textiles.

11. A textile product according to any preceding claim, wherein a respective layer of carbon-containing polymer material is disposed adjacent said first and second and/or intermediate layer.

12. A textile product according to Claim 11, wherein the, or each said, layer of carbon-containing polymer material is gas permeable.

13. A textile product according to Claim 3, 11 and 12, wherein the, or each said layer of carbon-containing polymer material is substantially impervious to moisture.

14. A method of manufacturing a textile product in accordance with any preceding claim, comprising the steps of:

mixing granules of active carbon with a liquid carrier to form an emulsion;

applying the emulsion to one face of each of said first and second layers;

securing together said first and second layers with said one faces facing inwardly, and forming said panels; and

removing the carrier from said first and second layers, to leave said granules within said pockets.

15. A method according to Claim 14, including the steps of allowing said liquid carrier to dry, at least partially, prior to securing together said first and second layers.

16. A textile product according to Claim 14 or 15, wherein said first and second layer are seamed together by stitching.

17. A textile product according to Claim 14, 15 or 16, wherein said carrier is an alginate.

18. A textile product according to Claim 17, wherein said alginate is a polymer alginate.

19. A textile product according to any one of Claims 14 to 18, wherein said carrier is removed from said first and second layers by scouring.

20. A textile product according to Claim 19, wherein water is used for said scouring.

21. A method of manufacturing a textile product, comprising the steps of:

providing two layers of carbon-containing polymer material;

adhering granules of active carbon to one face of at least one of said layers; and

securing said layers together with said one face therebetween.

22. A method according to Claim 21, wherein said granules are adhered to said face during manufacture of the respective said layers.

23. A textile product according to Claim 22, wherein said granules are adhered to said face whilst the respective said layer is wet with emulsified polymer.

24. A textile product, substantially as hereinb fore described with reference to the accompanying drawings.

25. A meth d of manufacturing a textile product, substantially as described herein.

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